CLAIMS

What is claimed is:

1. A nanoscale junction array, comprising:
   a. an elongated nanowire; and
   b. a plurality of elongated nanobelts, each having a proximal end and an opposite distal end, the proximal end of each nanobelt being attached to a different location on the nanowire, each nanobelt extending radially away from the nanowire.

2. The nanoscale junction array of Claim 1, wherein the elongated nanowire and the plurality of elongated nanobelts form a single crystal.

3. The nanoscale junction array of Claim 1, wherein each nanobelt extends radially away from the nanowire to form a wurtzite hexagonal structure.

4. The nanoscale junction array of Claim 3, wherein if the elongated nanowire is placed along a [0001] axis of a hexagonal coordinate scheme, then each of the plurality of elongated nanobelts will lie along an axis so as to have a symmetric orientation selected from a group comprising: $\pm [\bar{1}010]$, $\pm [0\bar{1}10]$, or $\pm [\bar{1}\bar{1}20]$.

5. The nanoscale junction array of Claim 3, wherein if the elongated nanowire is placed along a [0001] axis of a hexagonal coordinate scheme, then each of the plurality of elongated nanobelts will lie along an axis so as to have a symmetric orientation selected from a group comprising: $\pm [2\bar{1}\bar{1}0]$, $\pm [11\bar{2}0]$, or $\pm [1\bar{2}10]$.

6. The nanoscale junction array of Claim 1, wherein the proximal end of each nanobelt has a width of less than 100 nm and wherein the distal end of each nanobelt has a width in a range between 100 nm to 300 nm.

7. The nanoscale junction array of Claim 1, wherein the distal end of each nanobelt has a width of less than 100 nm and wherein the proximal end of each nanobelt has a width in a range between 100 nm to 200 nm

8. The nanoscale junction array of Claim 1, wherein the elongated nanowire comprises zinc oxide.

9. The nanoscale junction array of Claim 1, wherein each of the plurality of elongated nanobelts comprises zinc oxide.

10. The nanoscale junction array of Claim 1, wherein the distal end of each of the plurality of elongated nanobelts terminates in a metal particle.

11. The nanoscale junction array of Claim 10, wherein the metal particle comprises tin.

12. A nanopropeller, comprising:
    a. an elongated nanowire, having an elongated orientation; and
    b. a plurality of elongated nanoblades, each having a proximal end and an opposite distal end, the proximal end of each nanobelt being attached to a different location on the nanowire, each nanoblade extending radially away from the nanowire, each nanoblade having an elongated dimension terminated by the proximal end and the distal end with an elongated length between the proximal end and the distal end, a width dimension transverse to the elongated dimension and transverse to the elongated orientation of the elongated nanowire and having a length that is less than the elongated length, and a depth dimension having a length that is less than the length of the width dimension.

13. The nanopropeller of Claim 12, wherein the width dimension of each nanoblade is greater at the proximal end that at the distal end.

14. The nanoscale junction array of Claim 12, wherein if the elongated nanowire is placed along a [0001] axis of a hexagonal coordinate scheme, then each of the plurality of elongated nanoblades will lie along an axis so as to have a symmetric orientation selected from a group comprising: $\pm [2\bar{1}\bar{1}0]$, $\pm [11\bar{2}0]$, or $\pm [1\bar{2}10]$.

15. The nanoscale junction array of Claim 12, wherein the distal end of each elongated nanoblade has a width of less than 100 nm and wherein the proximal end of each nanoblade has a width in a range between 100 nm to 200 nm

16. The nanopropeller of Claim 12, wherein the nanowire comprises a piezoelectric material that generates a voltage when the nanowire is twisted and further comprising:
    a. a first electrical contact in electrical communication with a first location on elongated nanowire;
    b. a second electrical contact in electrical communication with a second location on elongated nanowire, the second location being spaced apart from the first location and at least one nanoblade disposed between the first location and the second location; and
    c. a circuit that senses a voltage between the first electrical contact and the second electrical contact, the voltage being indicative of an amount of twist in the nanowire.

17. The nanopropeller of Claim 16, wherein the nanopropeller is employed in a fluid flow detector and wherein the voltage indicates a rate of fluid flow.

18. The nanopropeller of Claim 12, wherein the nanowire comprises a piezoelectric material that twists as a function of a voltage applied thereto and further comprising:
    a. a first electrical contact in electrical communication with a first location on elongated nanowire;
    b. a second electrical contact in electrical communication with a second location on elongated nanowire, the second location being spaced apart from the first location

and at least one nanoblade disposed between the first location and the second location; and

c. a circuit that generates a voltage between the first electrical contact and the second electrical contact, the voltage inducing twist in the nanowire, thereby inducing rotation of the nanoblades.

19. The nanopropeller of Claim 18, wherein the nanopropeller is employed in a fluid propulsion system and wherein rotation of the blades causes movement of a fluid.

20. A method of making a nanoscale junction array, comprising the steps of:

a. placing a metal oxide and an oxide of a catalyst at a first location in a gas-controlled furnace;

b. placing a substrate at a second location, spaced apart from the first location, in the gas-controlled furnace;

c. evacuating the gas-controlled furnace to a first predetermined pressure;

d. for a first predetermined period of time, executing the following steps:

i. heating the metal oxide and the catalyst to a first predetermined temperature after the evacuating step, the first predetermined temperature sufficient to cause a metal vapor to boil off from the metal oxide;

ii. applying a carrier gas to the metal oxide and the catalyst at a predetermined flow rate; and

iii. maintaining the second location at a second predetermined temperature, less that the first predetermined temperature, thereby causing relatively rapid growth of a metal oxide nanowire between condensed particles of the catalyst and the substrate; and

e. after the first predetermined period of time, executing the following steps for a second predetermined period of time:

i. heating the metal oxide and the catalyst to a third predetermined temperature, different from the first predetermined temperature, the third predetermined temperature sufficient to cause a metal vapor to boil off from the metal oxide;

ii. applying the carrier gas to the metal oxide and the catalyst at a predetermined flow rate; and

iii. maintaining the second location at a fourth predetermined temperature, less that the third predetermined temperature, thereby causing relatively slow growth of a plurality of metal oxide nanobelts between condensed particles of the catalyst and the nanowire, the nanobelts and the nanowire forming the nanoscale junction array.

21. The method of making a nanoscale junction array of Claim 20, wherein the metal oxide comprises zinc oxide.

22. The method of making a nanoscale junction array of Claim 21, wherein the catalyst comprises tin.

23. The method of making a nanoscale junction array of Claim 20, wherein the substrate comprises Al_2O_3.

24. The method of making a nanoscale junction array of Claim22, wherein the step of placing the oxide of a catalyst comprises placing tin oxide in the gas-controlled furnace in a one-to-one ratio with the zinc oxide.

25. The method of making a nanoscale junction array of Claim 20, wherein the carrier gas comprises argon.

26. The method of making a nanoscale junction array of Claim 20, wherein the predetermined pressure is initially on the order of 2×10^{-3} Torr, further comprising the step of maintaining a pressure of between 300 Torr to 400 Torr inside the gas-controlled furnace once metal evaporation has begun.

27. The method of making a nanoscale junction array of Claim 20, wherein the carrier gas is applied at a gas flow rate of 50 sccm.

28. The method of making a nanoscale junction array of Claim 20, wherein the first predetermined period of time is about sixty minutes.

29. The method of making a nanoscale junction array of Claim 20, wherein the second predetermined period of time is about thirty minutes.

30. The method of making a nanoscale junction array of Claim 20, wherein the carrier gas comprises nitrogen.

31. The method of making a nanoscale junction array of Claim 30, wherein the carrier gas is applied at a gas flow rate of 20 sccm.

32. The method of making a nanoscale junction array of Claim 30, further comprising the step of including a reducing agent in the gas-controlled furnace.

33. The method of making a nanoscale junction array of Claim 32, wherein the reducing agent comprises graphite.

34. The method of making a nanoscale junction array of Claim 32, wherein the metal oxide comprises zinc oxide (ZnO) and wherein the oxide of a catalyst comprises tin oxide (SnO_2) and wherein the molar ratio of zinc oxide to tin oxide to graphite is: 3:4:1.5.

35. The method of making a nanoscale junction array of Claim 30, wherein the first temperature is about 1100 °C.

36. The method of making a nanoscale junction array of Claim 30, wherein the second temperature is between 600 °C and 700 °C.

37. The method of making a nanoscale junction array of Claim 30, wherein the third temperature is about 1300 °C.

38. The method of making a nanoscale junction array of Claim 30, wherein the fourth temperature is between 800 ^{o}C and 900 ^{o}C.